DAS

FOR DUMMIES®

DAS
Distributed Antenna System
Audit
Services

John Schurman AA7UJ

Understand DAS Basics

Know DAS Requirements

The right equipment and technology

Get more with additional coverage

Implementing a successful installation

10 Important DAS facts

DAS FOR DUMMIES®

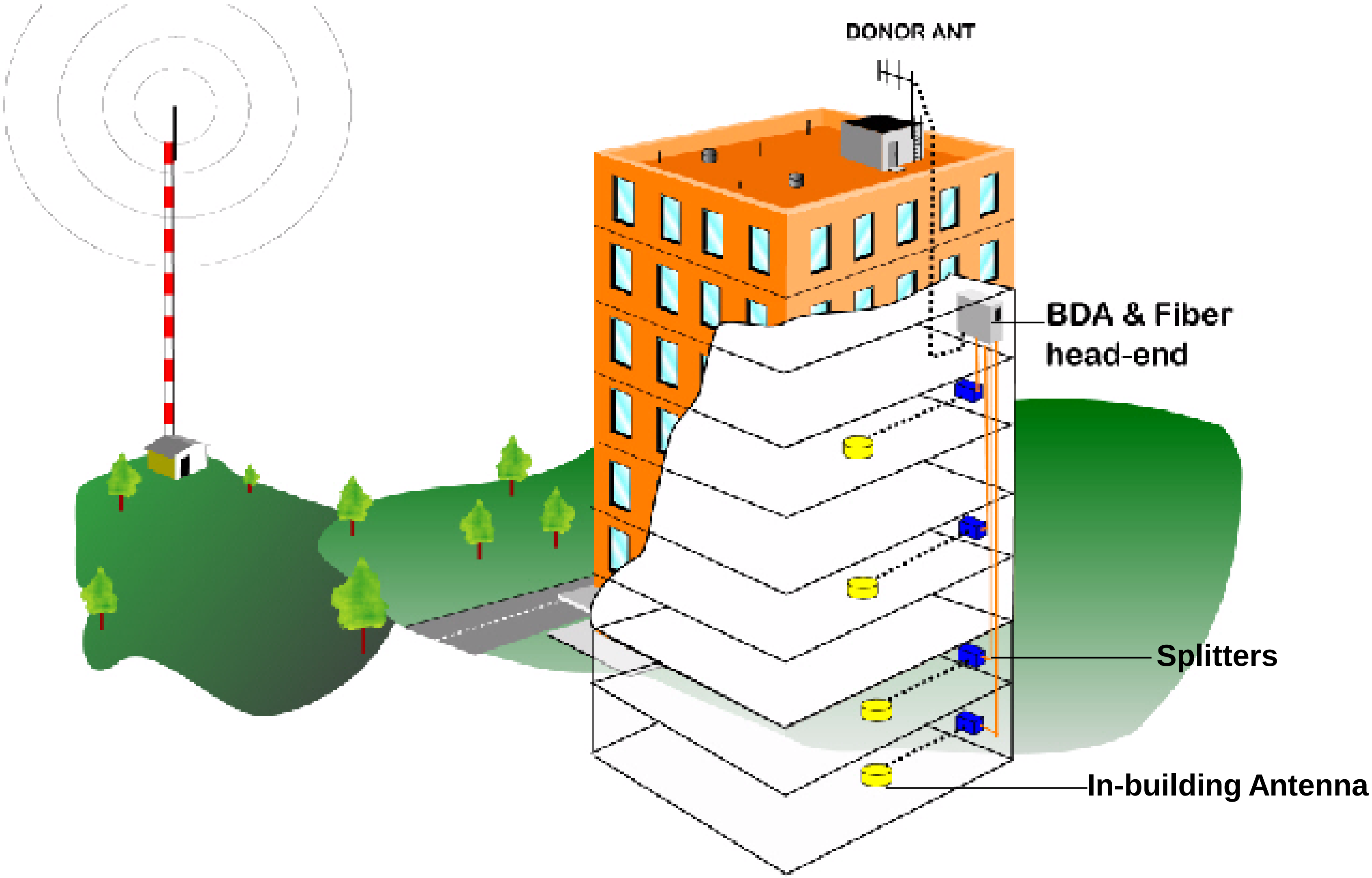
In-Building RF Systems

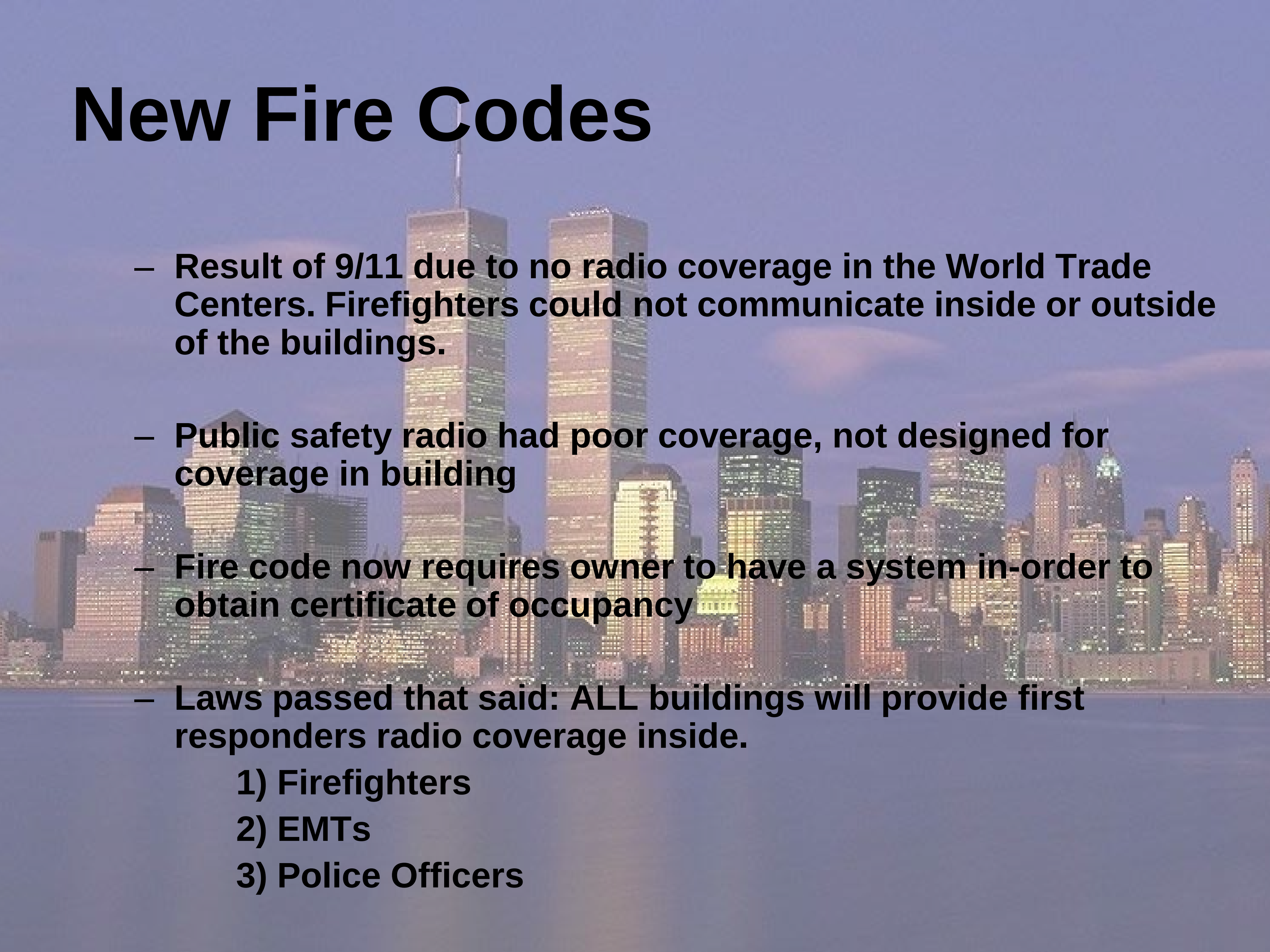
Two main parts:

- **Bi-Directional Amplifier (BDA)**
- **Distributed Antenna System (DAS)**

What is a BDA?

BDA/DAS System





New Fire Codes

- Result of 9/11 due to no radio coverage in the World Trade Centers. Firefighters could not communicate inside or outside of the buildings.

- Public safety radio had poor coverage, not designed for coverage in building

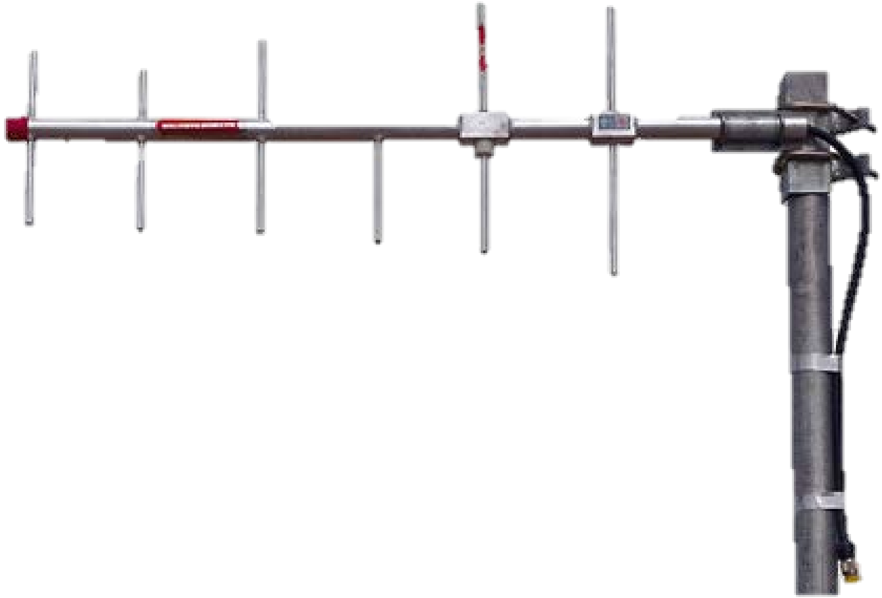
- Fire code now requires owner to have a system in-order to obtain certificate of occupancy

- Laws passed that said: ALL buildings will provide first responders radio coverage inside.
    1) Firefighters
    2) EMTs
    3) Police Officers

Exempt Structures

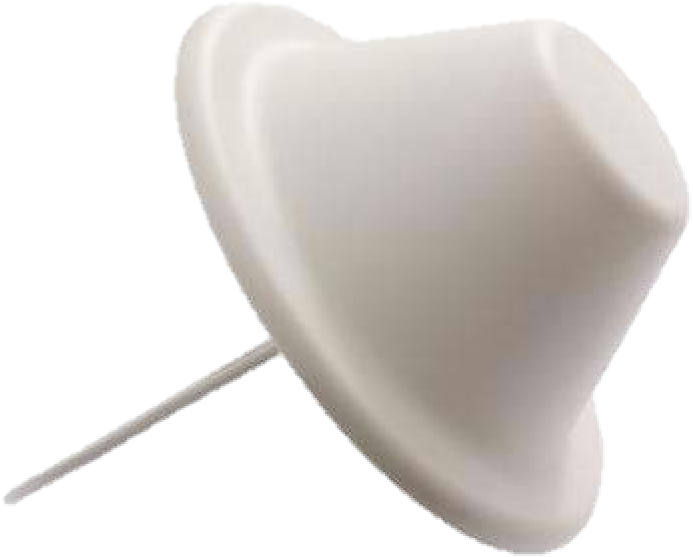
- Single family home
- Commercial wood frame without underground parking / storage
- Commercial less than 35 ft tall without underground parking / storage
- Pre-existing structure unless renovation, restoration or significant modification
- Building permits granted prior to 2009

Equipment



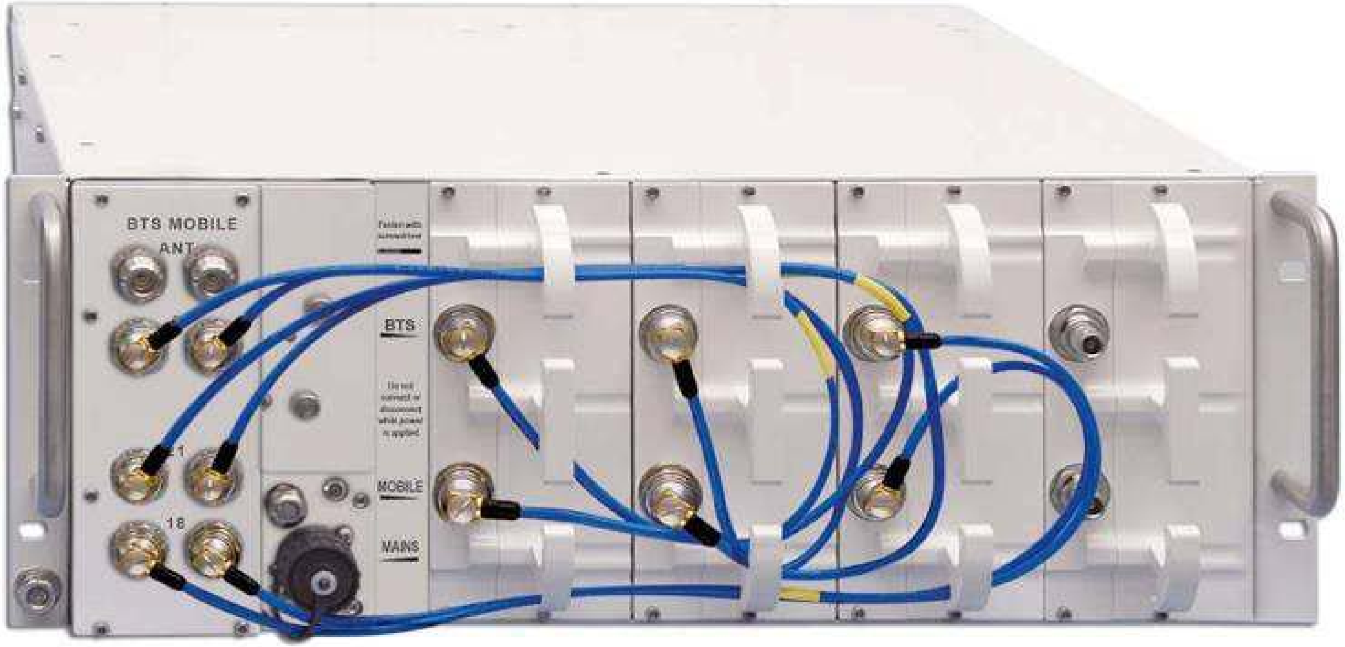
Donor Antenna

Equipment



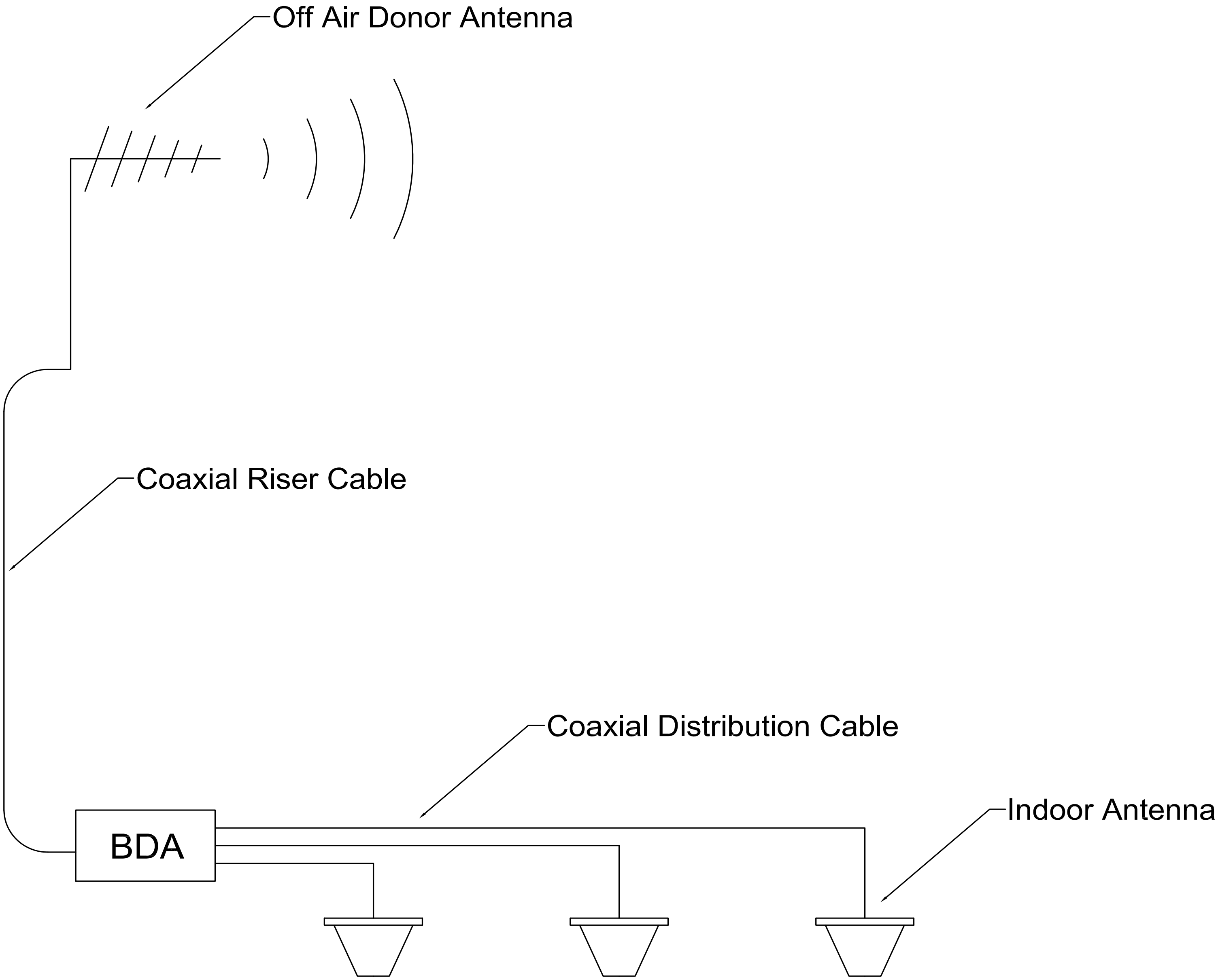
In-building antenna

Equipment

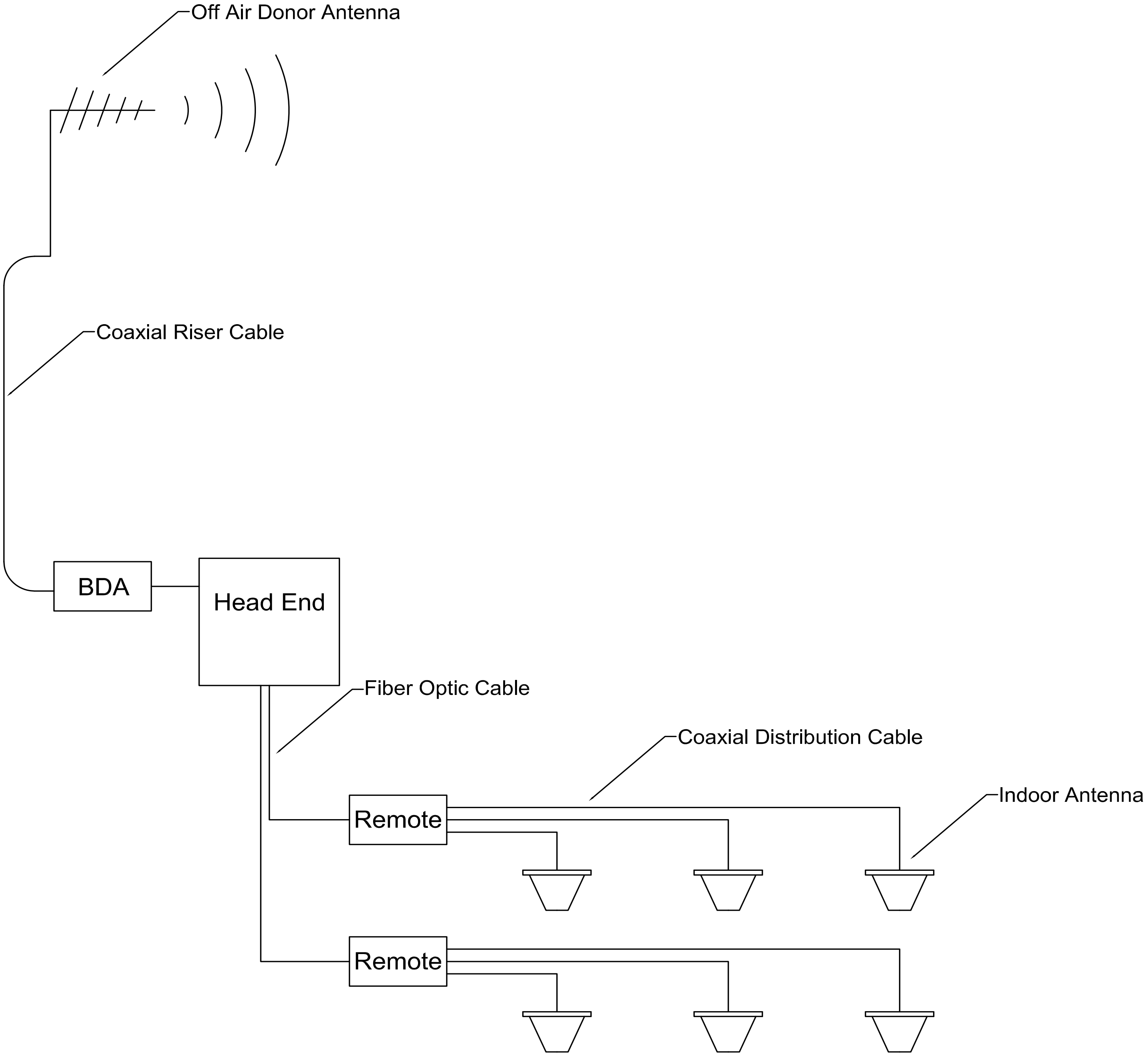


Bi-Directional Amplifier
(BDA)

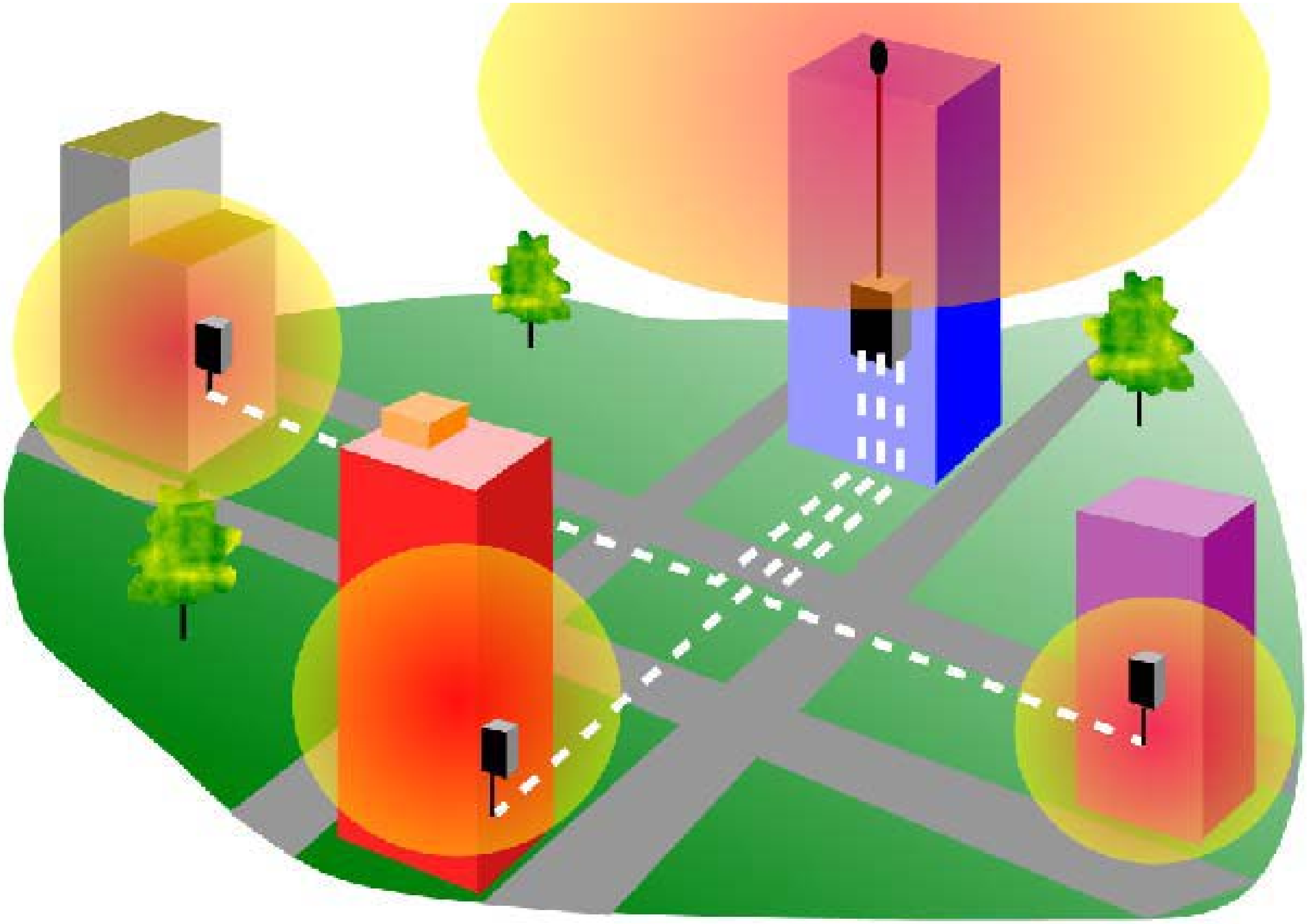
Passive "Off-Air" System



Active "off-Air" System



Campus System (Fiber)



Public safety Radio Systems

- Urban
  - King, Snohomish, Pierce Counties
    - 800 Mhz Public Safety band
    - Future 700 Mhz Public Safety band
- Rural
  - Other jurisdictions
    - VHF/UHF
    - Some 800 Mhz channels
- Any future channels assigned by FCC

Combine with Cellular Signals

- Provides cellular & mobile data device coverage
- Paging/Private radio systems
- 70% of all cell calls originate indoors

Cellular Compatibility

- **800 / 700 Mhz public safety systems are complementary with Cellular Service Operators**
  - **(806 - 824 MHz & 851 - 869 MHz)**

- **VHF (150 Mhz) / UHF (450 Mhz)**
  - **Not compatible**
  - **Generally requires a separate system**

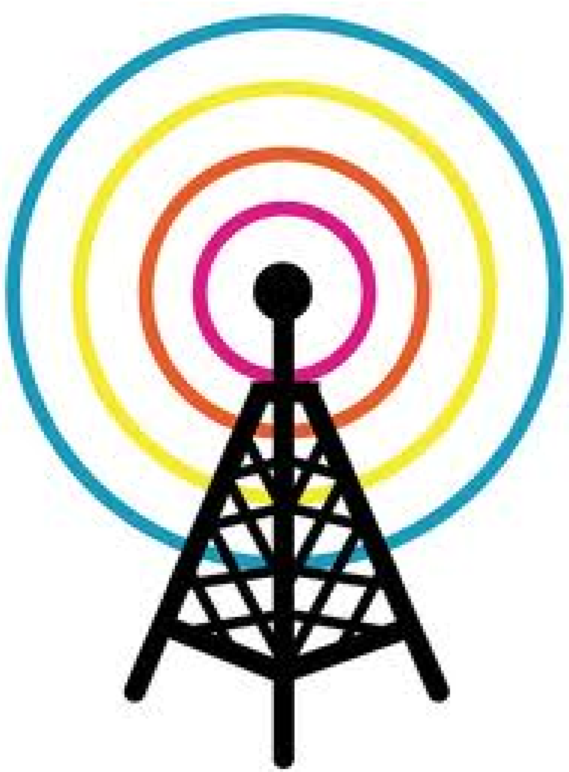
Public Safety Radio Coverage

- Signal level specified at -95 Dbm
  - 99% of elevators
  - Egress stairwells
  - Fire control center

- Signal level specified at -100 Dbm
  - 95% of building
- Local fire codes vary from IFC

Cellular Coverage

- **Signal level specified at -85 Dbm**
    - **Avoid dropped calls**
    - **Highest data rate speed**
    - **Overcome outdoor macro signal**

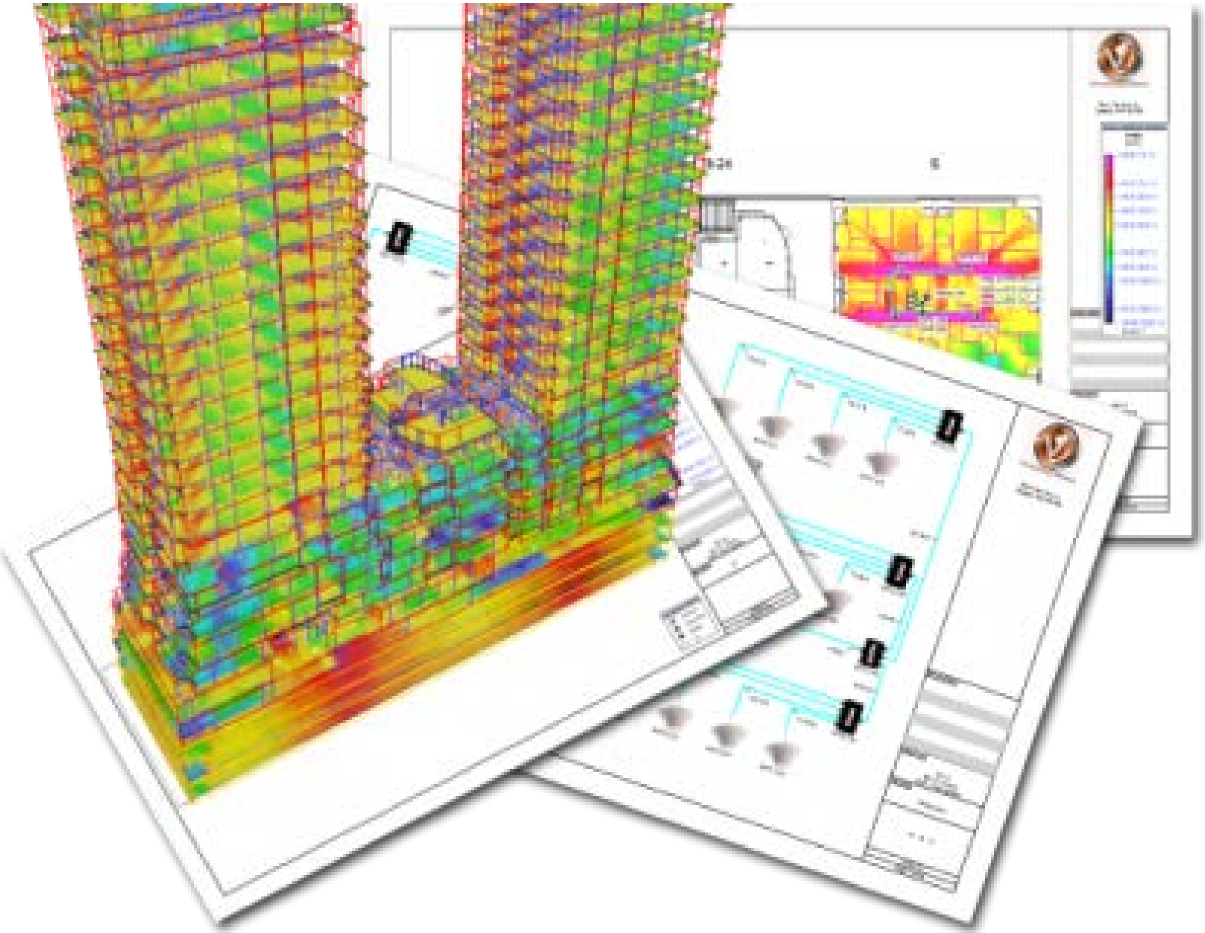


BDA and DAS Implementation

- Determine signals wanted
    - Public safety only or add cell coverage?

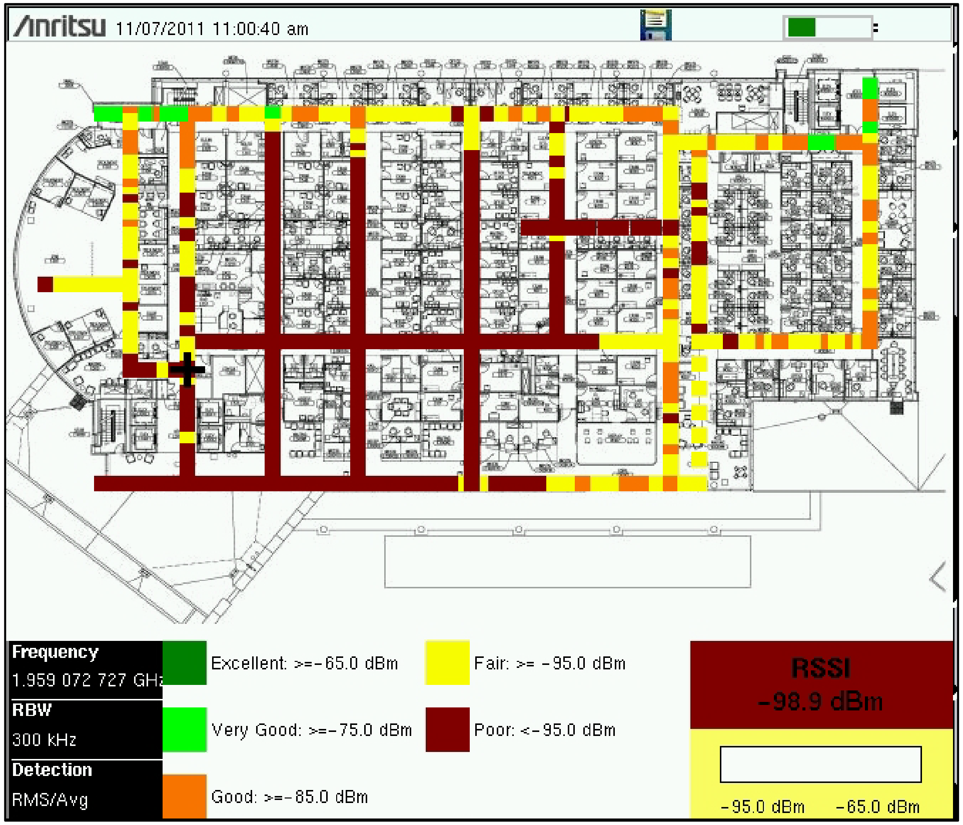
BDA and DAS Implementation

- **Determine signals wanted**
- **Perform site survey**



Downlink Coverage Report

- **Building drawings submitted with coverage map directly from instrumentation**



Anritsu 11/07/2011 11:00:40 am

Frequency
1.959 072 727 GHz

RBW
300 kHz

Detection
RMS/Avg

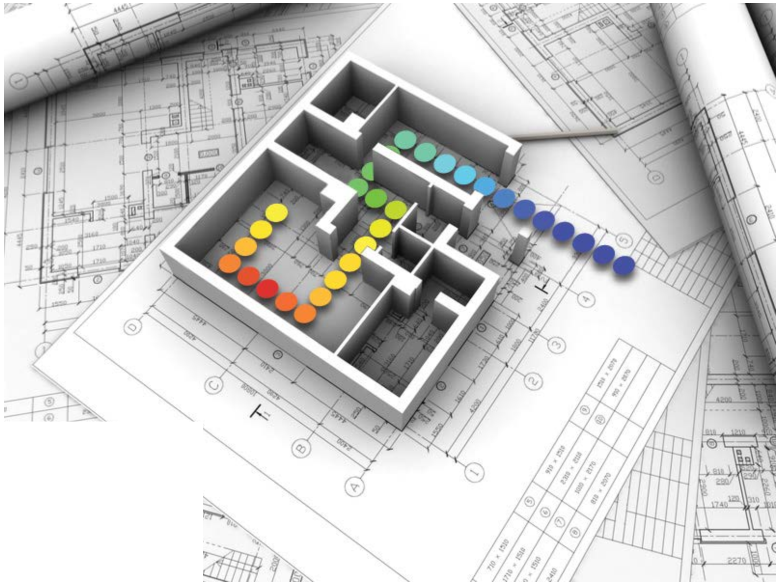
Excellent: >=-65.0 dBm
Very Good: >=-75.0 dBm
Good: >=-85.0 dBm
Fair: >= -95.0 dBm
Poor: <-95.0 dBm

RSSI
-98.9 dBm

-95.0 dBm -65.0 dBm

BDA and DAS Implementation

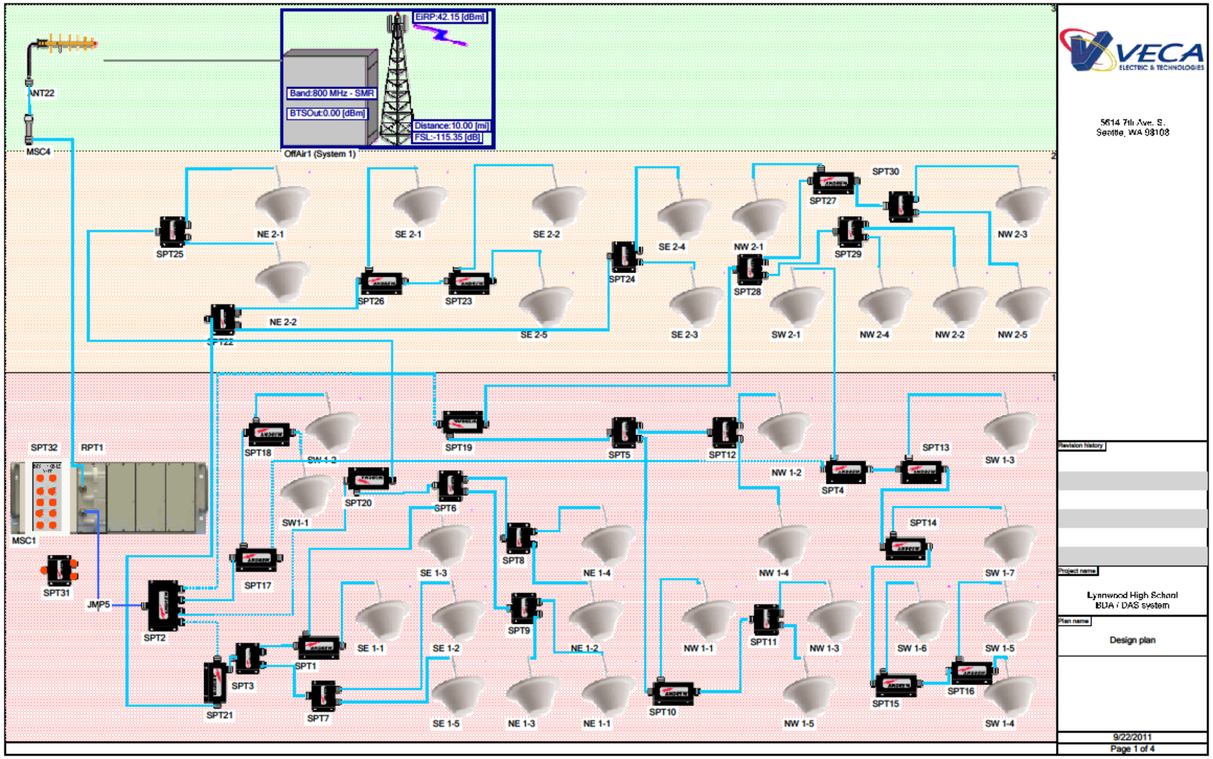
- Determine signals wanted
  - Public safety only or add cell coverage?
- Perform site survey
- Design solution



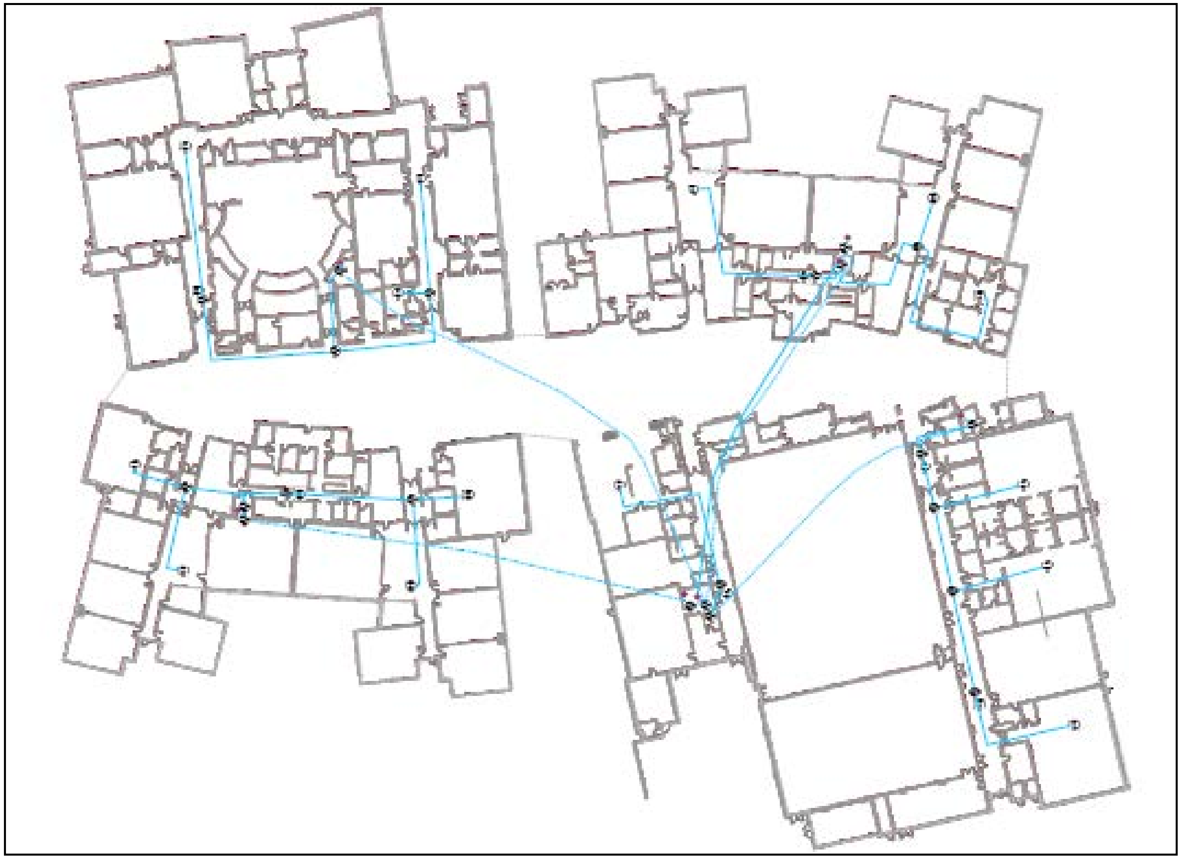
iBwave

Design Solution

I am not able to edit this for some reason – need a new photo w/o the VECA logo

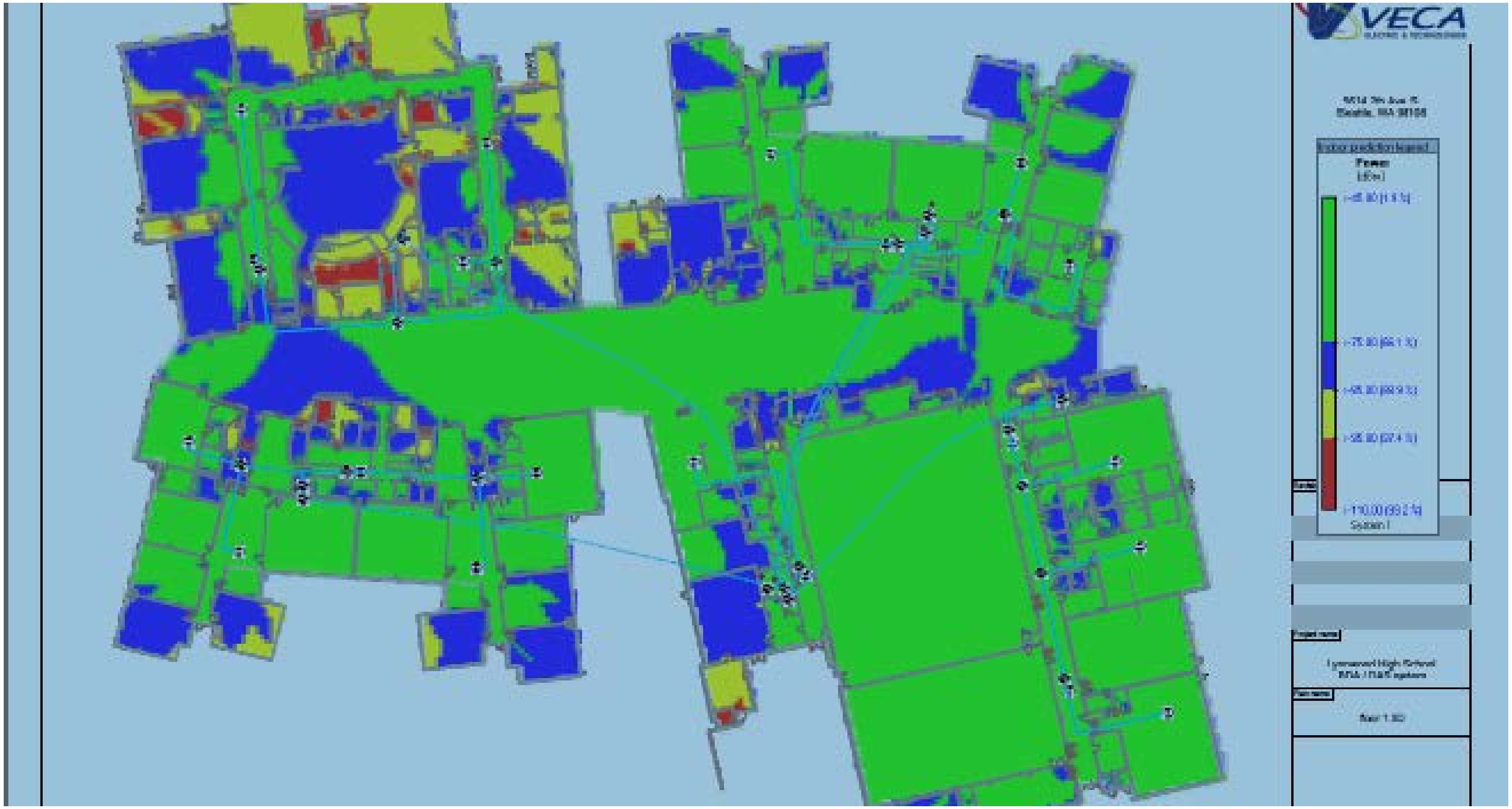


Design Solution



Design Solution

NEED NEW PICTURE THAT IS NOT BLUE



BDA and DAS Implementation

- **Determine signals wanted**
  - **Public safety only or add cell coverage?**
- **Perform site survey**
- **Design solution**
- **Installation**

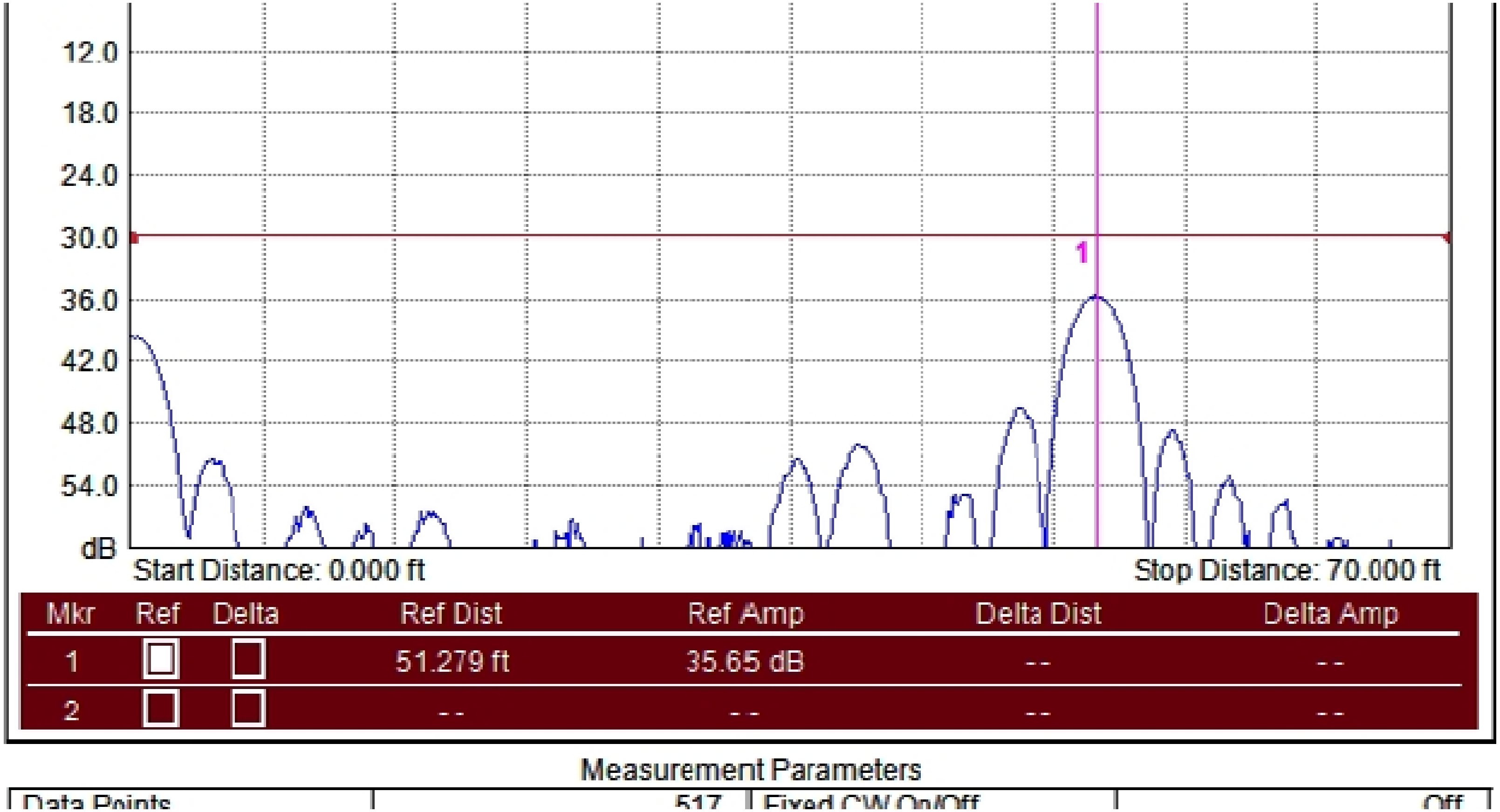
Installation

- Our partners
- Other contractors
- Owners

BDA and DAS Implementation

- Determine signals wanted
  - Public safety only or add cell coverage?
- Perform site survey
- Design solution
- Install
- Test

Sweep Test Each Cable Segment



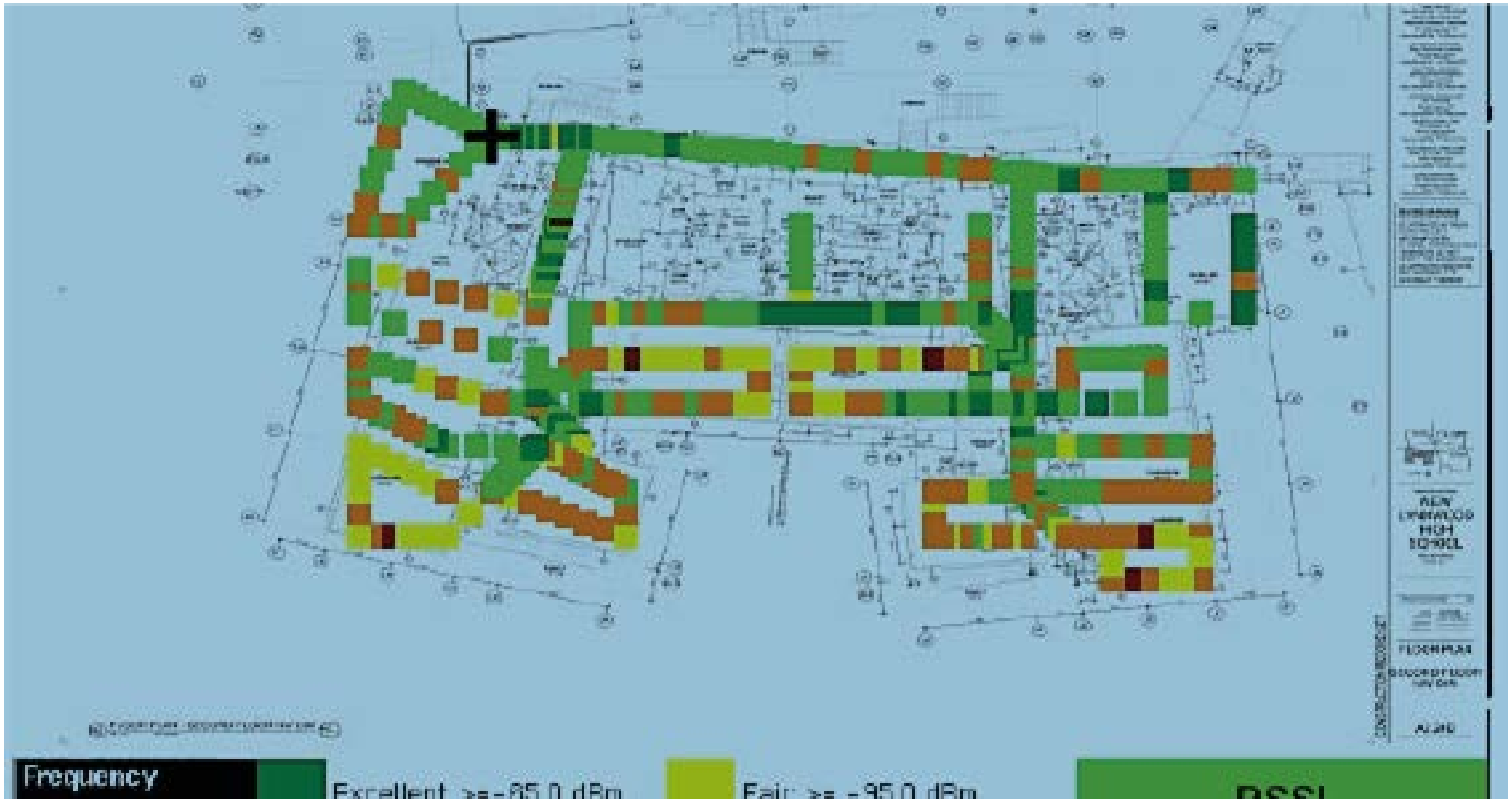
Mkr	Ref	Delta	Ref Dist	Ref Amp	Delta Dist	Delta Amp
1	☐	☐	51.279 ft	35.65 dB	--	--
2	☐	☐	--	--	--	--

Measurement Parameters

Data Points	517	Fixed CW On/Off	Off

Test for coverage

NEED NEW PICTURE
THAT IS NOT BLUE



BDA and DAS Implementation

- **Determine signals wanted**
    - **Public safety only or add cell coverage?**
- **Perform site survey**
- **Design solution**
- **Install**
- **Test**
- **Commissioning**

Commissioning

Microlab

Power Splitters, Dx-51/55FN

2, 3 & 4 way Block Style, Reactive Power Dividers
Super wideband, Low Loss, 380 - 2,700 MHz

- Multiple-Band Frequency Bands Tetra, Cellular and UMTS
- 500 Watt Average Power Rating
- Minimal RF Insertion Loss
- High Reliability, RoHS compliant
- N-female Connectors Standard
- Low Cost Design for ease of mounting to pole or wall

Microlab Model Dx-51/55FN series of 2, 3 and 4 way Power Splitters has been designed to evenly split high power cellular signals with minimal reflections or loss. The wide frequency range allows use with multiband antennas and leaky cable systems. With few solder joints and an air dielectric, the loss has been minimized and reliability enhanced. Similar splitters with 7-16 mm connectors are available as Dx-85/BBFO series. (04/10)

Cable routing report

Project name: Swedish - Redmond MOB
Project creation date: 11/11/2010
Design company: 5614 7th Ave. S.
Designer: JWS

ID	Cable from (Source side) Part ID	Part conn	Floor	Cable to (Mobile side) Part ID	Part conn	Floor	Cable type	Cable model	Cable mfg	Length (feet) + 0% Estimated	Real
CBL13	ANT4-1	Ant	roof	RPT1	BTS_800	floor 1	Coaxial	HL4RP-50	Andrew	214.79	
JMP1	RPT1	MOBILE_800	floor 1	SPT1-1	Through	floor 1	Coaxial	0dB-Loss-Jumper	Generic	Jumper	
CBL29	SPT1-1	Coupled	floor 1	SPT1-2	Through	floor 1				19.16	

INSTALLING CONFIDENCE

Operations & Maintenance

www.veca.com

Equipment list report

Project name: Swedish - Redmond MOB
Project creation date: 11/11/2010
Design company: 5614 7th
Designer: JWS

DTF - Return Loss

RED 2 1

Start Distance: 0.000 ft
Stop Distance: 40.000 ft

Link budget report

Swedish - Redmond MOB
11/11/2010
Design company: 5614 7th Ave. S.
Designer: JWS

Public Safety
Technical Requirements

- Power supply compliant with
  - NFPA 72, Section 1-5.
- NEMA 4 Waterproof cabinet
- Compliance tested with FCC label
- Field performance test
- Alarm signals to Fire Control Center
- Battery Back-up (IFC 12 hr – Local 24 hr)

Public Safety Permits

- Construction Permit
  - Electrical Installation Permit
- Operating Permit
  - Issued by Fire department
  - Provides legal permission to re-transmit RF signal

Cellular Permits

- **Operating Permit**
  - **Must have permission to transmit signal**
  - **Cellular companies may help with costs**
    - **Size of Venue**
    - **Number of customers**

Personnel Qualifications

- Engineer in possession of FCC General Radio
- Operators License

- Certified technician
  - NABER (National Association of Business and Education Radio)
  - PCIA (Personal Communications Industry Association)
  - ETA (Electronic Technicians International)
  - Equipment Manufacturers’ certification

Investment

- Public Safety Requirements Only
    - In buildings under 100,000 sq feet: $0.50 - $1.00 sq ft
- Public Safety and Cell Coverage
    - In buildings under 100,000 sq feet: $0.75 - $2.00 sq ft
- Buildings over 100,000 sq ft, cost per sq foot goes down

Benefits

- Cell coverage
  - More calls originate indoors
- Competitive advantage for multi-use buildings
- BYOD – Bring Your Own Device
  - New generation of portable devices
  - Fastest growing segment
- Regulatory Compliance

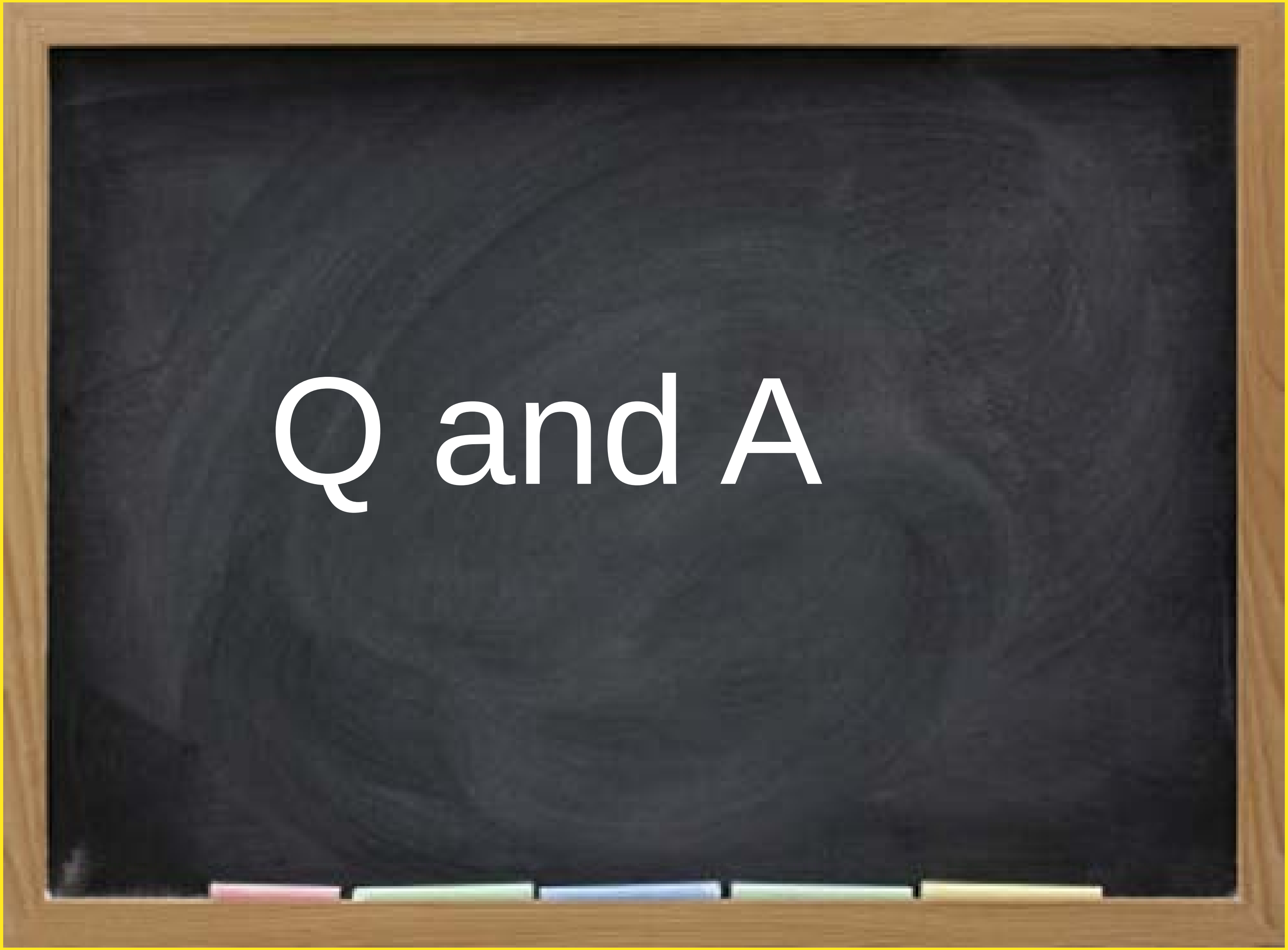
The Future

Key items on the horizon:

- **New Technologies**
- **New Spectrums**

TOP
10

1) Each installation is unique
2) Permission is required
3) A licensed technician is mandatory
4) You need the right vendor
5) You must provide proper signal coverage
6) Public safety radio signals must be provided
7) Local authority rules
8) Adding cellular network service may bring you benefits
9) Mobile device usage is increasing
10) Carrier coordination takes work



Q and A

THANK YOU!

John Schurman

RF Engineer

FCC GROL – PG00007074
ETA sr – SETWCM-R117752
CommScope - N504989VV145
iBwave Certified Level II